DOCUMENT RESUME

ED 313 842 EC 221 708

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TITLE Language and Cognitive Development of Deaf and Hearing Twin Sisters.
PUB DATE Jul 89
NOTE 19p.; In: Martin, David S., Ed. International Symposium on Cognition, Education, and Deafness (2nd, Washington, DC, July 5-8, 1989). Working Papers: Volume II.
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Case Studies; *Cognitive Development; Comparative Analysis; *Deafness; *Hearing Impairments; Interaction; *Language Acquisition; Play; Preschool Education; *Twins

ABSTRACT

In this case study, the language and cognitive development of a 4-year 5-month old profoundly deaf girl and her normally hearing identical twin sister were investigated by videotaping the twins in their home interacting with each other, the investigator, and family members. Materials used with the children were designed to elicit spontaneous, representative, expressive language and encourage imaginative play. A language sample of 100 utterances from each child was analyzed along dimensions of syntax, semantics and use. Interaction patterns were analyzed using a description of five dialogue patterns observed between twins and a behavioral observation plan for interpreting these dialogues. Imaginative play was analyzed as a measure of cognitive development. The pattern of differences in their language and imaginative play levels provide limited evidence that language and imaginative play are interrelated reflections of one developing cognitive system. (Author/PB)

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LANGUAGE AND COGNITIVE DEVELOPMENT OF DEAF AND HEARING TWIN SISTERS

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Abstract

In this case study, the language and cognitive development of a deaf 4-year-5-month old profoundly deaf girl and her normally hearing identical twin sister were investigated. The twins were videotaped in their home interacting with each other, the investigator, and family members. In addition, the deaf twin was videotaped interacting individually with the investigator in a clinical setting. Each session was 60-minutes long. The materials used with the children were designed to elicit spontaneous, representative, expressive language and to encourage imaginative play. Included were a picture story, pictures, Fisher-Price toys (doll house, barn, and parking garage), drawing paper, and colored markers.

A language sample of 100 utterances from each child was analyzed along dimensions of syntax, semantics, and use. The language analysis revealed delayed language development for the deaf twin and age-appropriate language for the hearing twin. The deaf twin's mean length of utterance in morphemes (MLU) was 1.49. Within her stage of language acquisition, she was using the semantic categories, syntactic forms, and functional uses reported for normally developing children who were approximately two to three years younger. The hearing twin's MLU was 6.01. Analysis revealed the use of semantic categories, syntactic forms, and functional uses appropriate for both her stage of language development and her chronological age.

Their interaction patterns were analyzed using a description of five dialogue patterns observed between twins and a behavioral observation plan for interpreting these dialogues. It was found that the girls engaged in only one of the five patterns -- quarreling -- indicative of twins' interaction. They did not use joint statements, mutual correction, verbal games, or repeating. The language production of the deaf twin decreased markedly both in quantity and quality during the interaction session when compared to the individual session. In the interaction session, she produced fewer utterances which were grammatically and semantically simpler. She relied primarily upon pointing and gesturing rather than verbal language. When interacting with her deaf sister, the hearing twin used simple language, many gestures, and few signs.

Imaginative play was analyzed as a measure of cognitive development. Representational thought, as manifested in language and imaginative play, is the major cognitive attainment for children between approximately 2 and 7 years of age. Analysis of their play revealed that while both girls engaged in imaginative play, the hearing sister spent significantly more time in imaginative play sequences than her deaf twin. Both girls used planned pretend but only the

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hearing sister used story line. These results give evidence for differences in their cognitive development.

The pattern of differences in their language and imaginative play levels provide limited evidence that language and imaginative play are interrelated reflections of one developing cognitive system.

Introduction

The child's ability to symbolize is manifested in the emergence of language and imaginative play during the second year of life. Several researchers have suggested that language and imaginative play are interrelated reflections of one developing cognitive system rather than two independent systems (Lombardino and Sproul, 1984; Rosenblatt, 1977; Vandenberg, 1981). These two systems may also be mutually reinforcing (Athey, 1984; Sachs, 1980). As aspects of the child's developing semiotic function (Piaget, 1962), both language and play require that the child be able to represent reality in thought.

Though the co-occurrence of language and imaginative play has been documented, precise interrelations between the two have not been determined (Fein, 1981; McCune-Nicolich, 1981). The stages of early language acquisition (Bloom and Lahey, 1978; Bowerman, 1978; Brown, 1973; deVilliers and deVilliers, 1979) have been used as a framework for mapping imaginative play behaviors. Children have been observed to play imaginatively at the one-morpheme stage, thus lending support for the simultaneous appearance of first words and first imaginative behaviors (McCune-Nicolich, 1981; Sachs, 1980; Terrell, Schwartz, Prelock and Messick, 1984). Others have not observed imaginative play until children begin to combine two morphemes (Casby and Ruder, 1983; Shore, O'Connell, and Bates, 1984). First imaginative play has been referred to as autosymbolic and is that play which is directly related to the child's own body. This stage is followed by a single scheme play in which the child's play extends beyond his/her own body. During this time, children have been found to use two-term semantic

relations in their language. Multi-scheme play has been found to occur concurrently with the appearance of combinatory language forms and grammatical morphemes (McCune-Nicolich, 1977; McCune-Nicolich, 1981; Westby, 1980).

Evidence for a developmental sequence in imaginative play which corresponds to early language development comes primarily from studies of normally developing children (Fein, 1981; McCune-Nicolich, 1981; Rubin and Pepler, 1982; Westby, 1980). Studies of handicapped children have confirmed the existence of relationships between imaginative play and language development. Casby and Ruder (1983) found no quantitative differences in the imaginative play of mentally retarded children and normally developing children when matched on mean length of utterance rather than chronological age. In their study of developmentally delayed preschool children, Lombardino and Sproul (1984) observed none of the subjects to have imaginative play levels which were less well developed than their language levels. Owings and Workman 91983) found that while the 2½- to 6-year-old language-delayed children in their study did not demonstrate age-level skills in play and language,their play always equalled or exceeded their language level. This discr-pancy between level in language and level in play was also observed by Terrell, Schwartz, Prelock, and Messick 91984). The play of the preschool language-impaired children in their study was developmentally more advanced when compared to language-matched normally developing children but was developmentally deficient relative to age norms.

Investigations into the play of hearing-impaired children provide limited support for a correspondence between imaginative play and language development, with delays in one system corresponding to delays in the other. In a study comparing the play of 4- to 5½-year-old severely and profoundly hearing-impaired children in their study demonstrated play deficits when

compared to a matched age group of hearing children. These play deficits include significantly less time engaged in dramatic play than their hearing peers. Mann (1984) found that the 3- to 6-year-old children with severe to profound hearing losses in her study demonstrated qualitatively similar play behaviors in free-play periods when compared to a matched age group of hearing children. However, the frequency of their play behaviors (i.e., the number of minutes engaged in imaginative play behaviors) was lower. Casby and McCormack (1985) observed 20 severely to profoundly hearing-impaired children, 38 to 69 months of age, in structured play situations and found that higher symbolic play scores were correlated with better developed communication skills.

The study of twins provides a unique opportunity to examine the relationship between cognition and language development of children who share their environment and who begin life endowed with the same genetic composition. Much of the research has been directed at exploring the relative influences of heredity and environment on linguistic and cognitive development (Coles, 1980; Fahey, Kamitomo, and Cornell, 1978; Hay and O'Brien, 1983; Mather and Black, 1984; Munsinger and Douglass, 1976).

Researchers have also examined the rate of twins' language development. The delays observed in their development (Day, 1932; Conway and Lytton, 1975) have been found to result from a language learning environment which is different from the environment of singletons (Conway and Lytton, 1975; Tomasello, Mannle, and Kruger, 1986). In these studies, twin children were observed to receive less speech directed specifically at them and to have fewer, shorter conversations with their mothers. Dales 91969) found that although the language development of twins begins more slowly, by 3 years of age, development approaches the norm. In their longitudinal study of one pair of twins, Waterman and Shatz (1982) found no delay in

the acquisition of personal pronouns but rather that the twins added a step in learning names. This difference in their development may have seemed to be a delay if the twins had been studied cross-sectionally rather than longitudinally. In examining the language between toddler twins, Malstrom and Silva (1986) found characteristics in their syntax and vocabulary uniquely related to their twin status.

One study focused specifically on the early vocal development of a profoundly deaf boy and his hearing twin brother. The authors found acoustic-phonetic differences in the babbling of the twins at 8, 12, and 15 months of age. They concluded that these differences could be used for identifying infants at risk for communication disorder (Kent, Osberger, Netsell, and Hustedde, 1987).

The relationship between language and cognitive development is of central concern to educators of hearing-impaired youngsters. the purpose of the present study was to investigate this relationship within the special environment of twins, one deaf and one hearing. The specific research questions were: (a) what is the pattern of sameness or difference in their language and cognitive development, and (b) what aspects of their interaction enhance or impede language and cognitive development?

Methods

Subjects

The subjects were one pair of identical twin sisters who were 4-years-5-months old. Dena had normal hearing. Jill had a profound sensori-neural hearing loss which had been diagnosed at 18 months of age. At that time she was fitted with hearing aids and began receiving speech and language therapy several times per week. The etiology of her loss was unknown. Her parents reported first noticing the loss when she was approximately 9 months

old. She had no other handicapping condition. At the time of this study, there was one other child in the family, an 8-year-old normally hearing sister.

Procedure

Two 60-minute sessions were used to observe the twins. The first session took place in a clinical setting in which Jill interacted individually with the investigator. The second session took place in the children's home 13 days later. The materials were designed to elicit spontaneous, representative, expressive language and to encourage imaginative play. Included were a picture story of The Three Bears picture book with no written words. Jill was encouraged to relate the story, but when it became apparent that she did not recognize it, the investigator told the story and encouraged Jill to elaborate on it. She added very little. In the session with her twin, Dena told the full story. However, Jill took the book from the investigator several times. She seemed to want to be "the teacher" physically if not verbally.

Within the individual session, Jill appeared interested in the pictures but needed much prompting to describe what she saw. In the home session, Dena described the pictures in detail; however, Jill frequently grasped the pictures to physically demonstrate "teacher" behavior.

Jill demonstrated enjoyment of the toys in the individual session and exhibited the greater proportion of expressive language during this play time. During the home sessions, both girls played animatedly with the toys, although Jill spoke and signed considerably less during this session than in the individual one.

Results

Language Analysis

A written transcription was made of each session. Mean length of utterance in morphemes (MLU) for each child's language was determined by dividing the total number of morphemes by the number of utterances.

Analysis methods included Brown's (1973) stages of language acquisition and Halliday's (1975) phases of functional language.

Semantic and Syntactic Analysis

Brown defined five stages of child language development which he considered to be core to the child's acquisition of meanings and forms. Within each stage he postulated the development of a major language process which accounted for much of the power within language and whose development in child language it had been possible to chart. Although the complete development of any process does not start and stop within a single stage, each stage was named for the process which is the major new or elaborated development within that MLU interval.

Jill produced 92 utterances in the individual session. Her MLU was calculated to be 1.49, which placed her in Brown's Stage I language (1.00-1.99). Of the total corpus, 48.7% were single-morpheme utterances and 40% were two-morpheme utterances. She used six of the eight 2-term semantic relations identified by Brown as indicative of Stage I language (2 agent + locative, 3 action + object, 1 action + locative, 2 entity + locative, 1 possessor + possession, 4 entity +attributive, 0 agent + object, and 0 demonstrative + entity). In addition, she used one 3-term semantic relation (entity + attributive + locative). She also demonstrated use of several Stage II grammatical morphemes (4 present progressive without auxiliary, 1 irregular

past, 2 regular plural, 4 "in", 1 "on", 0 regular past, 0 third person singular present indicative regular and irregular, 0 possessive treated as a noun inflection, 0 "a" and "the", 0 contractible and uncontractible copula, 0 contractible and uncontractible auxiliary). Of the Stage III modalities of the simple sentence, she used 8 yes/no questions (use of voice intonation only without sentence transformation) but no wh- questions (questions requiring that a constituent be specified), no negatives, and no imperatives. She used no Stage IV embeddings of one sentence within another and only one Stage V coordination of a simple sentence with the conjunction "but".

Jill's 18 utterances in the joint session with Dena used considerably less language than she had produced in the individual session. Of this total, 77.8% were single-morpheme utterances and 22.2% were two-morpheme utterances. She used one of the Stage I two-term semantic relations (entity + attributive) and no Stage III grammatical morphemes. She used no features from the other three stages. Her MLU in this session was 1.33.

Dena produced 276 utterances in the joint session. Her MLU was 6.01 which placed her well beyond Stage V language (3.75+). She demonstrated the use of all of the 14 grammatical morphemes and all of the Stage III modalities. She also used the three types of embedded sentences from Stage IV including object-noun phrase complements, embedded wh-questions, and relative clauses. Of the Stage V coordinators, Dena used "and", "because", "but", and "so".

Analysis of Functional Use

Halliday considered the learning of language to be essentially the learning of a semantic system. He found that this content-expression system is well under way before the child has any words or structures at all. Halliday related this system of meanings to linguistic functions.

that is, the functions that language serves for the child. He found that the developing child used six functions -- instrumental, regulatory, interactional, personal, heuristic, and imaginative. The seventh function, the informative, he found did not emerge until considerably after the others and is dominant in the language of adults.

Of Halliday's seven categories of language functions, it was found that Jill used five in the individual session. The largest percentage of these were interactional (70.7%). The interactional is the function that language serves for interacting with others. Second in frequency was the imaginative (22.7%) which is the function language serves for creating an environment of one's own. Jill also used the heuristic (9.3%), which is the function that language serves for exploring the environment, usually in the form of questions. She used the personal (9.3%), which is the function that language serves for exploring the environment, usually in the form of questions. She used the instrumental (8%), which is the function that language serves to satisfy one's needs, usually through requesting. She did not use the regulatory, which is the function that language serves to control the behavior of others. And she did not use the informative, which is the function that language serves to communicate information to someone who does not already possess that information. These functional categories overlap so that one utterance can serve more than one function. Analysis of the functions Jill used in the joint session revealed her ability to use language differently within a different environment. Although the majority of her utterances were still interactional (61.1%), she used the regulatory in this setting (33.3%), which she had not used at all in the individual session. She also used the instrumental (11.1%) and the personal (5.6%) language, but she used no imaginative or heuristic language.

Dena's language was largely informative (70.7%). In addition, she used the heuristic (21.3%), imaginative (21.3%), interactional (10.7%), personal (4%), regulatory (2.7%), and the instrumental (1.3%) functions.

Analysis of Interaction

Interaction patterns were analyzed using Savic and Jocic's (1975) description of five dialogue patterns observed between twins. It was found that Jill and Dena engaged in only one of the patters -- quarreling. In approximately 50% of their dialogue, they quarreled either verbally or nonverbally. During the remainder of their interaction, they requested and demanded things of each other or identified play objects. They did not use the other four patterns indicative of twins' interaction -- joint statements, mutual correction, verbal games, or repeating. Within the one-hour session, they interacted with each other 19 times; 9 were initiated by Jill and 10 by Dena.

Within the individual session, Jill predominantly used oral and sign language to communicate. She also used some gestures.

Within the joint session, her oral language was largely babbling (which she had not used at all in the individual session). She used few signs and many gestures. She used the picture book and pictures to demonstrate concepts rather than to express them through language. When she interacted with Dena, she frequently pointed to express herself. Dena used few signs when interacting with Jill and simplified her language and her speech when talking directly to her twin.

Analysis of Imaginative Play

Imaginative play was analyzed using Westby's (1980) cognitive play scale. At Stage I, the child is aware that objects exist when not seen and demonstrates means-end behavior. At

Stage II, the child demonstrates purposeful exploration of toys. In Stage III the first truly symbolic play appears and Westby refers to it as autosymbolic play. At this stage, the child is able to pretend such activities as going to sleep and eating. At Stage IV, the child is able to extend symbolic play beyond his/her own body. It is at this stage that Westby found children to use two-term semantic relations. At Stage V, the child is able to pretend activities of others and to represent daily experiences in symbolic play. However, the pretend toys at this stage are realistic in appearance and size. Westby found children at this stage to use the following grammatical morphemes: present progressive without auxiliary, regular plural, and possessive. At Stage VI, the child is able to represent less frequently experienced events in symbolic play such as going to the doctor. Westby found children at this stage to ask questions in which a constituent needs to be specified (wh- questions). At Stage VII, the child is able to develop a scenario for symbolic play action. Rather than only play in differentiated segments, the child combines these segments into a sequence. Westby found that children at this stage use past and future verb tenses. At Stage VIII, the child is able to engage in symbolic play with less realistic toys. The toy might be in miniature, such as a Fisher-Price barn, or quite unlike the real object, such as a block of wood for a telephone. Westby found that children at this stage engage in dialogue with toys and change their expressive language depending upon the listener/receiver. At Stage IX, the child begins to problem-solve events she/he has not experienced. Westby found that children at this stage respond appropriately to how and why questions and use modals and conjunctions. At Stage X, the child is able to talk about anticipated or planned play and to engage in full cooperative play. Westby found that children at this stage begin to use relational terms such as then, when, first, and before.

In the individual session, Jill demonstrated some imaginative play behavior representative of children at Stage V as well as some behavior representative of Stage VIII. At Stage V, the child is able to represent daily experiences in symbolic play. When Jill played with the dollhouse, she demonstrated several familiar experiences. For example, she said/signed "sick" as she lay a figurine into a bed; she said/signed "baby wake up" and took the figurine from the cradle, put it on the dressing table, and pantomimed changing its diapers; she said/signed "eat" while putting a figurine on a chair at the kitchen table. However, when she played with the barn nd farm animal figurines, she used no language and did not appear to engage in imaginative play. Her interaction with this toy was to take all the animals out of the barn and stand them up. When she completed this action, she searched for another toy. She demonstrated imaginative play with the third toy, the garage, but used no language while playing. Her interaction included putting figurines into the cars, moving them through the garage, and putting gasoline in the cars. She did not demonstrate ability to represent less frequently experienced events in imaginative play which would have been indicative of Stage VI play. She did not develop a story line or scenario for any of her play action which would have been representative of Stage VII play. Jill did demonstrate one type of Stage VIII play -- ability to play imaginatively with Fisher-Price toys which, as miniatures, are considered less realistic in nature. She did not engage in dialogue with the toys, which is the other type of Stage VIII play.

In the joint session, Jill demonstrated no imaginative play behaviors. She manipulated the toys by doing such things as moving a car back and forth and putting a fence together. She used no expressive language while playing except to identify the toys (e.g., "car", "boy").

Dena demonstrated Stage X symbolic play behaviors. She played an equivalent amount of time with toys more representative of daily experiences, such as the house, as with toys less representative of daily experiences, such as the barn. She developed a number of different scenarios, or story lines, for her imaginative play with all the toys. She engaged in dialogue with the toys and used planned pretend (i.e., she talked about anticipated or planned play). An example of a scenario is the following:

> This is a baby and this is a baby chair/
>
> Oh she fell off/
>
> She keeps on falling down/
>
> It's supper time so everyone has to get off/
>
> You wanna eat over for dinner/
>
> Um all right we'll eat over/

Discussion

Language analysis revealed that the twins were at very different stages of language development. The hearing twin, Dena, expressed her semantic intentions within a range of complex syntactic forms. Her functional uses of language were quite similar to the adult's. The deaf twin, Jill, used the semantic relations found in the language of children at the early stages of development. The grammatical morphemes she used were those observed by Brown to be first in the order of acquisition by normally developing children. Her language functions were indicative of what Halliday called a transitional phase between a simple content-expression system (with no vocabulary and no grammar) and ability to use language to express all social meanings.

Analysis of interaction indicated that the twins communicated with each other largely to identify common play objects and to argue about them. Jill used considerably less language with her sister than she used with the investigator, and the language she did use was grammatically simpler. Dena also simplified her language when communicating with her twin as compared to the language she directed to the investigator. The girls did not appear to have developed any special twin language that was idiosyncratic to their interactions with each other.

Analysis of their imaginative play demonstrated that both girls were able to engage in symbolic play behaviors. Dena's cognitive play level was consistent with her language development stage. Jill's cognitive play level is somewhat in advance of her language development stage, though she demonstrated some mixed abilities. Linguistically, Jill is at the one- to two-morpheme stage of development; yet cognitively, she is able to symbolize about activities beyond her own body, to represent real-life experiences in her play, and to play with unrealistic-type toys. These cognitive abilities are all indicative of a child able to express him/herself in language more syntactically complex than Jill used.

Language and imaginative play both require that the child be able to symbolize. This capacity for symbolic functioning was found in both the deaf and hearing twin sisters. The pattern of differences between their language and cognitive play levels provides limited evidence that there is a relationship between the development of language and the development of imaginative play in the child's cognitive system.

The type of language that the girls used in interaction during play would not appear to enhance the language nor cognitive development of either twin, though there is no evidence that the development of either child was being impeded. The deaf twin was developing a linguistic system consistent with patterns of normal language development but at a slower rate

than her normally hearing sister. Imaginative play requires less abstraction than language and, indeed, the deaf twin's cognitive play levels were above her language levels, though delayed when compared to her sister. Given an environment which offered much opportunity to play with a same-age, genetically identical sisters, it is unclear why the deaf and hearing twins were unable to enhance each other's linguistic and cognitive development. The major implication is that bringing young children at similar ages together does not necessarily create an environment of effective communication and interaction which will concomitantly stimulate language and cognitive development. By understanding the interrelationship of the symbolic processes in cognition and the effects of the environment on the development of these processes, educators can help young children to stimulate each other through language and play.

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